

**METHODS OF SAMPLING AND TESTING  
MT 416-04  
PROCEDURE FOR SELECTING SAMPLING LOCATIONS  
BY RANDOM SAMPLING TECHNIQUE**

**1 Scope:**

- 1.1** The following is a method of selecting sampling locations of various materials from roadways and trucks hauling asphalt mixture.

**2 Definitions:**

- 2.1** *Lot* - a quantity of material that one desires to control. It may represent a day's production, a specified tonnage, a specified number of truckloads, a specified time period during production.
- 2.2** *Sample* - a segment of a lot chosen to represent the total lot. It may represent any number of sub-samples.
- 2.3** *Sub-sample* - a segment of a sample, taken from a unit of the lot, i.e., specified ton, a specified time, a specified truckload.
- 2.4** *Sample Unit* - a portion of sub-sample taken from a unit of a lot and combined with one or more other sample units to make up a sub-sample.

**3 Selecting Sampling Locations from Roadways:**

- 3.1** Table X-1, pages 5 to 8, contains random numbers for the general sampling procedures. To use this table for selecting locations for collecting samples, the following steps are necessary:

- 3.1.1** Determine the number of sampling locations within a section by selecting the maximum average longitudinal distance desired between samples and dividing the length of the section by the maximum average longitudinal distance.
- 3.1.2** Select a column of random numbers in Table X-1 by placing 28 one inch square pieces of cardboard, numbered 1 thru 28, into a container, shaking them to get them thoroughly mixed, and drawing out one.
- 3.1.3** Go to the column of Random Numbers identified with the number drawn from the container. In sub-column A, locate all numbers equal to and less than the number of sampling locations desired.
- 3.1.4** Multiply the total length of the section by the decimal values in sub-column B, found opposite the numbers located in sub-column A. Add the results to the station number at the beginning of the section to obtain the station of the sampling location.
- 3.1.5** Multiply the total width of the pavement in the section by the decimal values found in sub-column C, opposite the numbers in sub-column A, to obtain the offset distance from the left edge of the pavement to the sampling location.

**4 Example:**

- 4.1** Given: A completed plant mix surfacing project, 24 feet wide, 16,500 feet long, running from Station 100+00 to 265+00.

**4 Example:** (continued)

- 4.1.1** For sampling purposes it is desired to take one pavement core for each 2-lane mile. The number of sampling locations for this section, then are:

$$\frac{16,500}{5,280} = 3.1 = 3 \text{ locations}$$

- 4.1.2** The number 16 drawn from a container identifies this column of random numbers in Table X-1 to use.

- 4.1.3** The numbers selected from column 16 are:

	<u>Col. A</u>	<u>Col. B</u>	<u>Col. C</u>
	3	.548	.688
	2	.739	.298
	1	.331	.925

- 4.1.4** Station number of sampling location:

<u>Length of Section, Feet</u>	<u>X</u>	<u>Col. B</u>	<u>Distance from Beginning of Section, Feet</u>	<u>Station at Beginning of section</u>	<u>Station Number of Sampling Location</u>
16,500	.548		9042	100+00	190+42
16,500	.739		12190	100+00	221+90
26,500	.331		546	100+00	105+46

- 4.1.5** Offset distance from left edge of pavement to sampling location, feet.

<u>Width of Pavement, Feet</u>	<u>x</u>	<u>Col. C</u>	<u>=</u>	<u>Offset Distance From Left Edge of Pavement to Sampling Location, Feet</u>
24		.688		16.5
24		.298		7.2
24		.925		22.2

- 4.1.6** Sampling locations are:

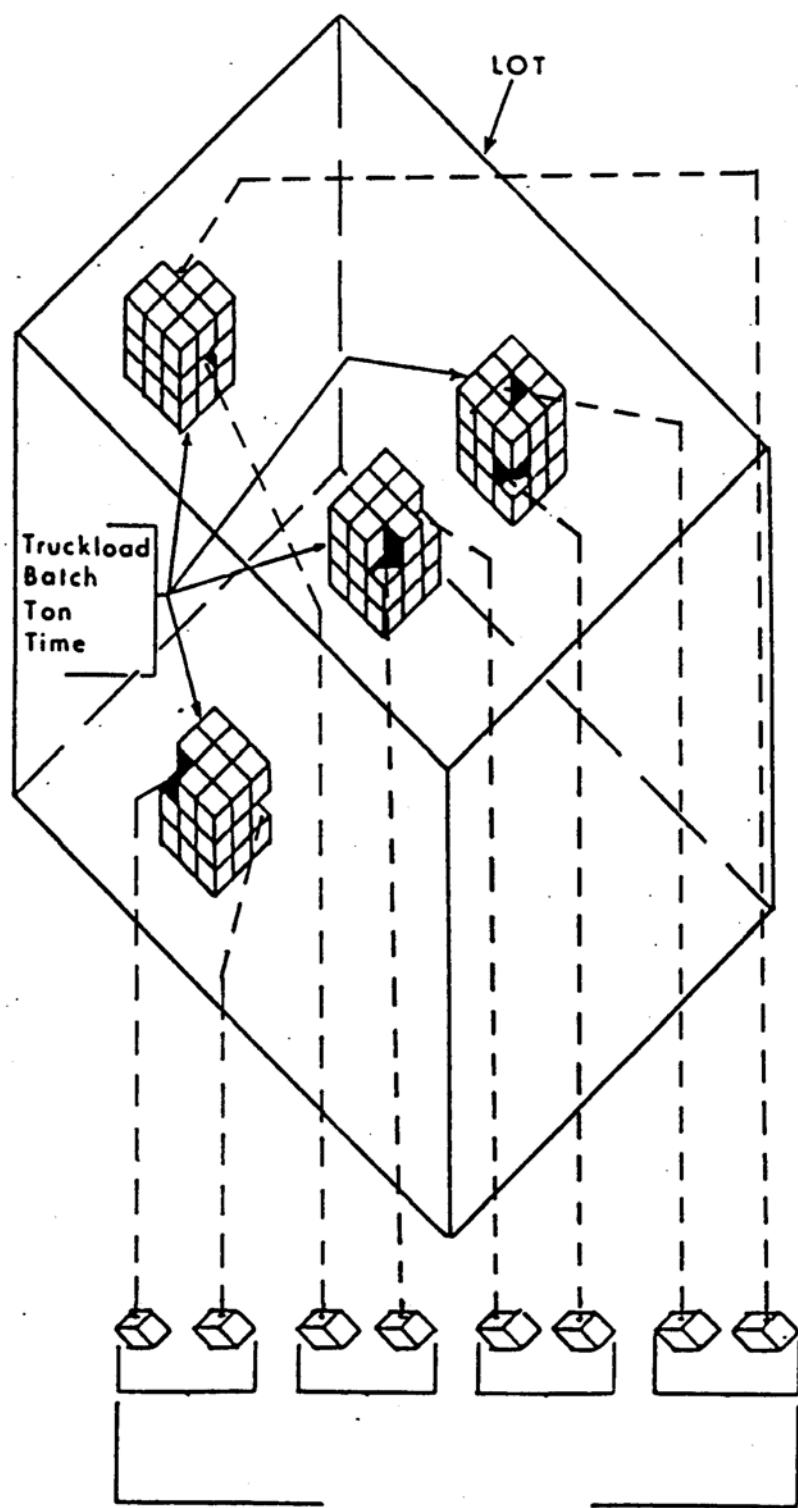
<u>Station Number</u>	<u>Distance From Left Edge, Feet</u>
190+42	16.5
221+90	7.2
105+46	22.2

**5 Selecting Sampling Locations in Trucks Hauling Asphalt Mixture:**

- 5.1** In this procedure, the following steps are necessary to select the sampling locations:

**5 Selecting Sampling Locations in Trucks Hauling Asphalt Mixture:** (continued)

- 5.1.1** Select lot size--it can be time (hours), an average day's production (tons), a selected tonnage [example: 2,000 tons (1815 mg)] or a selected number of truckloads. (A lot size of a day's production is recommended for this procedure as being convenient and easy to randomize.)
  - 5.1.2** Select the number of samples desired per lot. One sample per lot, made up of *four* sub-samples, is the minimum recommended.
  - 5.1.3** Select the number of locations in each truckload from which sampling units of asphalt mixtures will be taken to combine into one sub-sample. *Two* sampling units per sub-sample are recommended.
  - 5.1.4** Assign each truckload of mixture in the lot a number, beginning with 1 for the first truckload and number them successively to the highest number in the lot. Find the truckload numbers for sampling by the following procedure:
    - 5.1.4.1** Place consecutively numbered [1 through \_\_\_\_\_ one-inch (25 mm)] square pieces of cardboard, equal to the number of truckloads in the lot, into a container (such as a bowl). Mix them thoroughly before each drawing.
    - 5.1.4.2** Draw a number of cardboard squares from the container equal to the number of sub-samples desired for the lot. The numerals on the cardboard squares will be the truckloads to be sampled.
  - 5.1.5** Choose for each sub-sample desired the location in the truckload for each of the sampling units. Use the following steps:
    - 5.1.5.1** Divide the truck beds into equal quadrants and number them 1 through 4 in any order desired.
    - 5.1.5.2** Place four consecutively numbered [1 through 4, one-inch (25 mm)] square pieces of cardboard into a container (such as a bowl). Mix them thoroughly before each drawing.
    - 5.1.5.3** Draw out an amount of cardboard squares equal to the number of sample units desired. The numerals on each square drawn represent the quadrants from which the sample will be taken. Replace the cardboard squares and repeat this step for each sample unit of each sub-sample to be taken.
- Note - The principles involved may be applied to any other type of sampling of various materials which use the measurements of time, quantity, depth or other distinctive measurements of a construction phase. There are other random methods such as using a watch or deck of cards that are readily adaptable to obtaining roadway samples and they may be used provided the full benefit of obtaining random samples is accomplished.*



**FIGURE 1—Schematic diagram illustrating *Lot, Sample, Subsample, and Sample Unit.***

TABLE X-1-RANDOM NUMBERS FOR GENERAL SAMPLING PROCEDURE

Col. No. 1			Col. No. 2			Col. No. 3			Col. No. 4			Col. No. 5			Col. No. 6			Col. No. 7		
A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
15	.011	.576	05	.048	.879	21	.013	.220	18	.089	.716	17	.024	.863	30	.030	.901	12	.029	.286
21	.101	.300	17	.074	.156	30	.034	.853	10	.102	.330	24	.060	.012	21	.096	.198	18	.112	.284
23	.129	.916	18	.102	.191	10	.052	.746	14	.111	.925	26	.074	.639	10	.100	.161	20	.114	.848
30	.158	.434	06	.105	.257	25	.061	.954	28	.127	.840	07	.167	.512	29	.133	.388	03	.121	.636
24	.177	.397	28	.179	.447	29	.042	.507	24	.132	.271	28	.194	.776	24	.138	.062	13	.178	.640
11	.202	.271	26	.187	.844	18	.017	.887	19	.285	.899	03	.219	.166	20	.168	.564	22	.209	.421
16	.204	.012	04	.188	.482	24	.103	.849	01	.224	.037	29	.264	.284	22	.232	.953	16	.221	.311
08	.208	.418	02	.208	.577	07	.139	.159	30	.234	.938	11	.282	.262	14	.259	.217	29	.235	.356
19	.211	.798	03	.214	.402	01	.175	.641	22	.405	.295	14	.379	.994	01	.275	.193	28	.264	.941
29	.233	.070	07	.245	.080	23	.196	.873	03	.421	.282	13	.394	.405	06	.277	.475	11	.287	.199
07	.260	.071	15	.248	.851	24	.240	.981	13	.451	.212	06	.410	.157	02	.294	.497	02	.336	.992
17	.262	.308	29	.261	.087	14	.255	.374	02	.461	.023	15	.438	.700	24	.311	.144	15	.393	.488
25	.271	.180	30	.302	.883	06	.310	.043	06	.487	.539	22	.453	.635	05	.351	.141	19	.437	.655
06	.302	.672	21	.318	.088	11	.316	.453	08	.497	.394	21	.472	.824	17	.370	.011	24	.466	.773
01	.409	.406	11	.376	.936	13	.324	.385	25	.503	.893	03	.488	.118	09	.388	.484	14	.531	.014
13	.507	.693	14	.420	.814	12	.251	.275	15	.594	.603	01	.525	.222	04	.410	.073	09	.562	.678
02	.575	.454	27	.438	.676	20	.271	.535	27	.620	.894	12	.561	.900	25	.471	.510	04	.601	.675
18	.591	.318	08	.467	.205	08	.409	.495	21	.629	.841	08	.652	.508	13	.486	.779	10	.612	.859
20	.610	.821	09	.474	.138	16	.445	.740	17	.691	.583	18	.668	.271	15	.515	.867	26	.673	.112
12	.631	.597	10	.492	.474	03	.494	.929	09	.708	.689	20	.736	.634	23	.567	.798	23	.718	.770
27	.651	.281	13	.499	.892	27	.543	.387	07	.709	.012	02	.763	.253	11	.618	.502	21	.753	.614
04	.661	.953	19	.511	.520	17	.625	.171	11	.714	.049	23	.804	.140	28	.636	.148	30	.758	.851
22	.692	.089	23	.591	.770	02	.699	.073	23	.720	.693	25	.828	.423	27	.650	.741	27	.765	.563
05	.779	.346	20	.404	.730	19	.702	.934	03	.748	.413	10	.843	.627	16	.711	.508	07	.780	.534
09	.787	.173	24	.454	.330	22	.816	.802	20	.781	.603	16	.858	.849	19	.778	.812	04	.818	.187
10	.818	.837	12	.728	.523	04	.838	.166	26	.820	.384	04	.903	.227	07	.804	.675	17	.837	.353
14	.895	.631	16	.753	.344	15	.904	.116	04	.843	.002	09	.912	.382	08	.806	.952	05	.854	.818
26	.912	.376	01	.806	.124	28	.969	.742	12	.884	.582	27	.935	.162	18	.841	.414	01	.862	.133
28	.920	.163	22	.878	.984	09	.974	.046	29	.926	.700	20	.970	.582	12	.918	.114	08	.915	.538
03	.945	.140	25	.939	.162	05	.977	.494	16	.931	.601	19	.973	.327	03	.992	.389	25	.973	.384

(Continued) TABLE X-1-RANDOM NUMBERS FOR GENERAL SAMPLING PROCEDURE

Col. No. 8			Col. No. 9			Col. No. 10			Col. No. 11			Col. No. 12			Col. No. 13			Col. No. 14		
A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
.09	.042	.071	14	.061	.095	26	.038	.071	27	.074	.079	16	.073	.087	03	.033	.091	26	.035	.175
17	.141	.411	02	.065	.097	30	.064	.371	06	.084	.394	23	.078	.056	07	.047	.391	17	.089	.363
02	.143	.221	03	.094	.228	27	.073	.876	24	.098	.524	17	.096	.076	28	.064	.113	10	.149	.681
03	.162	.899	14	.122	.945	09	.095	.368	10	.133	.919	04	.153	.163	12	.066	.360	28	.238	.073
03	.285	.016	18	.158	.430	05	.180	.741	15	.187	.079	10	.254	.834	26	.076	.532	13	.244	.767
28	.291	.034	25	.193	.469	12	.200	.851	17	.227	.767	06	.284	.428	30	.087	.101	24	.262	.346
04	.369	.537	24	.224	.572	13	.259	.327	20	.234	.571	12	.305	.414	02	.127	.187	08	.264	.451
01	.436	.386	10	.225	.223	21	.264	.481	01	.243	.908	25	.319	.901	06	.144	.068	18	.285	.311
20	.450	.289	09	.233	.838	17	.263	.463	04	.317	.291	01	.323	.212	25	.202	.474	02	.340	.131
18	.455	.789	20	.290	.120	23	.263	.063	29	.350	.911	08	.416	.372	01	.247	.023	29	.353	.478
21	.488	.715	01	.297	.242	20	.364	.366	26	.380	.104	13	.432	.556	23	.253	.373	06	.359	.270
14	.496	.276	11	.337	.760	16	.393	.363	28	.423	.864	02	.469	.827	24	.329	.631	20	.387	.249
15	.503	.342	19	.389	.064	02	.423	.540	22	.487	.526	29	.503	.787	10	.328	.363	14	.392	.694
04	.515	.693	13	.411	.474	08	.432	.736	05	.552	.511	15	.518	.717	27	.338	.412	03	.408	.077
16	.532	.112	20	.447	.893	10	.476	.668	14	.564	.357	28	.524	.998	13	.356	.991	27	.440	.280
22	.557	.357	22	.478	.321	03	.508	.774	11	.572	.306	03	.542	.352	16	.401	.792	22	.461	.830
11	.559	.620	29	.481	.993	01	.601	.417	21	.594	.197	19	.585	.462	17	.423	.117	16	.527	.003
12	.650	.216	27	.562	.403	22	.687	.917	09	.607	.524	03	.693	.111	21	.481	.838	30	.531	.486
21	.672	.320	04	.566	.179	29	.697	.862	19	.650	.572	07	.733	.838	08	.560	.401	25	.678	.360
13	.709	.273	08	.603	.758	11	.701	.603	18	.664	.101	11	.744	.946	19	.564	.190	21	.725	.014
07	.745	.687	15	.632	.927	07	.728	.498	23	.674	.428	18	.793	.748	05	.571	.034	03	.797	.595
30	.780	.285	06	.707	.107	14	.745	.679	02	.697	.674	27	.802	.967	18	.587	.584	15	.801	.927
19	.843	.097	28	.737	.161	24	.819	.444	03	.767	.578	21	.826	.487	15	.604	.145	12	.836	.294
26	.846	.366	17	.846	.130	15	.840	.823	16	.809	.529	24	.835	.832	11	.641	.298	04	.854	.982
29	.861	.307	07	.874	.491	25	.863	.568	30	.838	.294	26	.855	.142	22	.672	.156	11	.884	.978
23	.906	.874	05	.860	.828	06	.878	.215	13	.845	.470	14	.861	.462	20	.674	.887	19	.886	.832
24	.919	.809	23	.911	.459	18	.930	.601	08	.855	.524	20	.874	.625	14	.752	.881	07	.929	.932
10	.932	.513	26	.960	.363	04	.934	.827	07	.867	.718	30	.929	.056	09	.774	.560	09	.932	.206
06	.961	.504	21	.978	.194	28	.963	.004	12	.881	.722	09	.935	.582	29	.921	.732	01	.970	.692
27	.969	.811	12	.982	.113	19	.981	.020	22	.937	.872	22	.947	.797	04	.959	.099	23	.973	.082

(Continued) TABLE X-1-RANDOM NUMBERS FOR GENERAL SAMPLING PROCEDURE

A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Col. No. 15	Col. No. 16	Col. No. 17	Col. No. 18	Col. No. 19	Col. No. 20	Col. No. 21														
.15	.023	.979	.19	.062	.588	.13	.045	.004	.25	.027	.290	.12	.032	.075	.20	.030	.861	.01	.010	.946
.11	.118	.465	.25	.080	.218	.18	.086	.878	.04	.057	.571	.30	.075	.493	.12	.034	.291	.10	.014	.939
.07	.134	.172	.09	.131	.295	.26	.126	.990	.26	.059	.026	.28	.120	.541	.22	.045	.893	.09	.032	.346
.01	.139	.230	.18	.136	.381	.12	.128	.661	.07	.105	.176	.27	.145	.689	.28	.147	.073	.06	.065	.180
.16	.145	.122	.05	.147	.864	.30	.146	.337	.18	.107	.558	.02	.209	.957	.03	.150	.937	.15	.151	.012
.20	.165	.520	.12	.158	.365	.05	.169	.470	.22	.128	.827	.26	.272	.818	.04	.154	.867	.16	.185	.455
.04	.185	.481	.28	.214	.184	.21	.244	.433	.23	.156	.440	.22	.299	.317	.19	.158	.359	.07	.227	.277
.09	.211	.616	.14	.215	.737	.23	.274	.849	.15	.171	.157	.18	.306	.75	.29	.304	.615	.02	.204	.400
.25	.249	.890	.15	.227	.809	.10	.290	.925	.20	.252	.066	.15	.348	.156	.18	.390	.536	.18	.328	.799
.13	.252	.577	.11	.280	.898	.01	.323	.490	.04	.248	.576	.16	.381	.710	.17	.403	.392	.20	.352	.288
.30	.273	.088	.01	.321	.925	.24	.252	.291	.14	.275	.302	.01	.411	.607	.23	.404	.182	.26	.371	.216
.18	.277	.489	.10	.299	.992	.15	.261	.155	.11	.297	.589	.13	.417	.715	.01	.415	.457	.19	.446	.734
.22	.372	.958	.20	.417	.787	.29	.274	.882	.01	.358	.305	.21	.472	.484	.07	.437	.696	.13	.487	.598
.10	.461	.075	.08	.439	.921	.08	.432	.139	.09	.412	.089	.04	.478	.885	.24	.446	.346	.12	.346	.440
.28	.519	.536	.20	.472	.484	.04	.467	.264	.16	.429	.834	.25	.479	.080	.26	.465	.768	.24	.550	.038
.17	.520	.090	.24	.498	.712	.22	.508	.880	.10	.491	.203	.11	.564	.104	.15	.511	.313	.03	.504	.780
.03	.523	.519	.04	.516	.396	.27	.632	.191	.28	.542	.306	.10	.576	.659	.10	.517	.290	.22	.621	.930
.26	.573	.502	.03	.548	.498	.16	.661	.836	.12	.563	.091	.29	.645	.397	.30	.556	.853	.21	.629	.154
.19	.634	.206	.23	.597	.308	.19	.673	.629	.02	.593	.321	.19	.739	.298	.25	.661	.837	.11	.634	.908
.24	.635	.810	.21	.681	.114	.14	.680	.890	.30	.692	.198	.14	.749	.759	.09	.574	.599	.05	.696	.459
.21	.679	.841	.02	.739	.298	.28	.714	.508	.19	.705	.445	.08	.754	.919	.13	.613	.762	.23	.710	.078
.27	.712	.344	.29	.792	.038	.06	.719	.441	.24	.709	.717	.07	.799	.183	.11	.698	.783	.29	.726	.585
.05	.710	.497	.22	.829	.324	.09	.735	.040	.13	.820	.719	.23	.834	.647	.14	.715	.179	.17	.749	.914
.23	.861	.104	.17	.834	.647	.17	.741	.906	.05	.848	.866	.04	.837	.978	.16	.770	.128	.04	.802	.186
.12	.863	.377	.16	.909	.608	.11	.747	.205	.27	.867	.623	.03	.849	.964	.08	.815	.385	.14	.835	.319
.29	.882	.633	.06	.914	.420	.20	.850	.047	.03	.883	.333	.24	.851	.109	.05	.872	.490	.08	.870	.546
.08	.902	.020	.27	.958	.856	.02	.859	.556	.17	.900	.443	.05	.859	.915	.21	.885	.999	.26	.871	.539
.04	.951	.482	.26	.981	.976	.07	.870	.612	.21	.914	.883	.17	.863	.220	.02	.938	.177	.25	.971	.269
.02	.977	.171	.07	.983	.624	.03	.916	.647	.29	.950	.753	.09	.863	.147	.27	.961	.980	.27	.984	.252

(Continued) TABLE X-1-RANDOM NUMBERS FOR GENERAL SAMPLING PROCEDURE

Col. No. 22			Col. No. 23			Col. No. 24			Col. No. 25			Col. No. 26			Col. No. 27		
A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
12	.051	.052	24	.051	.087	08	.015	.521	02	.039	.003	16	.026	.102	21	.050	.952
11	.048	.060	03	.053	.256	16	.068	.994	16	.061	.599	01	.013	.886	17	.085	.403
17	.089	.309	29	.100	.159	11	.118	.400	26	.068	.054	04	.088	.686	10	.111	.624
01	.091	.371	13	.102	.463	21	.124	.563	11	.073	.812	22	.090	.002	05	.154	.157
10	.100	.709	24	.110	.316	18	.153	.158	07	.123	.649	13	.114	.614	06	.164	.841
02	.164	.056	11	.123	.208	26	.192	.676	17	.161	.189	05	.138	.228	16	.215	.363
23	.179	.529	09	.138	.182	01	.237	.000	18	.166	.040	10	.216	.565	08	.222	.520
21	.187	.051	06	.194	.115	12	.283	.077	28	.248	.171	02	.233	.610	13	.269	.477
22	.205	.343	22	.234	.460	03	.286	.318	06	.255	.117	07	.278	.337	02	.288	.012
28	.230	.488	20	.274	.107	10	.317	.724	15	.261	.928	30	.405	.273	25	.333	.633
19	.243	.001	21	.331	.292	05	.337	.844	10	.301	.811	06	.421	.807	28	.348	.710
27	.267	.990	08	.344	.065	25	.441	.236	24	.363	.023	12	.426	.583	20	.362	.961
15	.283	.440	27	.382	.979	27	.469	.786	22	.378	.792	08	.471	.708	14	.511	.989
16	.352	.069	07	.387	.863	24	.473	.237	27	.379	.959	18	.473	.738	26	.540	.903
03	.377	.648	28	.411	.776	20	.475	.761	19	.420	.357	19	.510	.207	27	.587	.643
06	.397	.769	16	.414	.999	06	.537	.001	21	.467	.943	03	.512	.329	12	.603	.743
09	.409	.428	04	.515	.993	07	.610	.238	17	.494	.223	15	.610	.329	29	.619	.895
14	.465	.408	17	.518	.827	09	.617	.041	09	.620	.081	09	.645	.354	23	.623	.333
13	.499	.651	05	.539	.620	13	.641	.648	30	.623	.104	14	.680	.884	22	.624	.076
04	.539	.972	02	.623	.271	22	.644	.291	01	.625	.777	26	.703	.622	18	.670	.904
18	.560	.347	30	.637	.274	04	.688	.856	08	.651	.790	29	.739	.394	11	.711	.253
26	.575	.891	14	.714	.364	19	.717	.232	12	.715	.399	25	.739	.386	01	.790	.392
29	.594	.712	15	.730	.107	02	.776	.504	23	.782	.091	24	.803	.402	04	.813	.611
20	.760	.920	19	.771	.592	29	.777	.548	20	.810	.371	27	.842	.491	19	.843	.732
05	.847	.925	23	.780	.462	14	.821	.223	01	.841	.724	21	.870	.435	03	.844	.511
25	.872	.891	10	.924	.888	23	.848	.264	29	.862	.009	28	.904	.367	30	.858	.299
24	.874	.135	12	.929	.204	30	.892	.817	25	.891	.973	23	.948	.367	09	.929	.199
08	.911	.215	01	.917	.714	28	.943	.190	04	.917	.264	11	.954	.142	24	.931	.263
07	.946	.045	23	.974	.398	15	.975	.962	13	.958	.990	17	.993	.989	15	.939	.947